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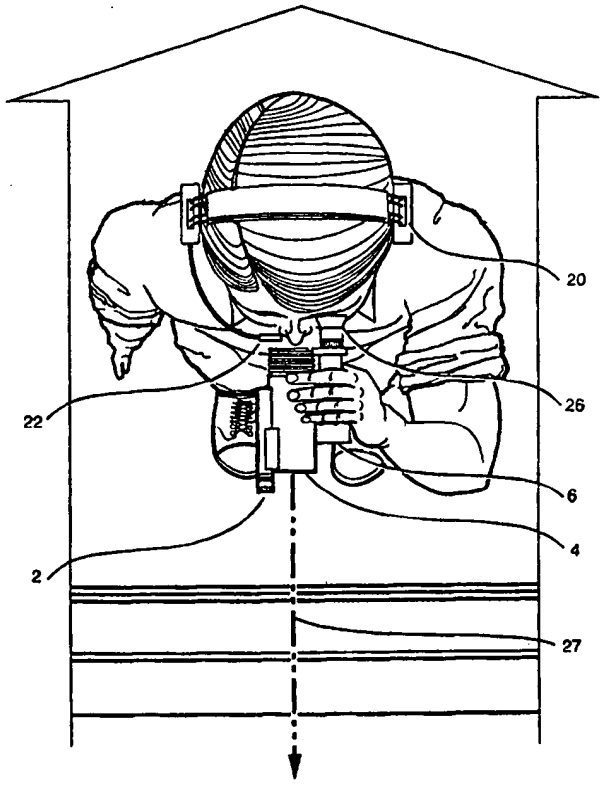
(54) Title: LASER COMMUNICATION DEVICE

(57) Abstract

A portable laser communication transceiver for transmitting and receiving information imposed on laser beams. A communication signal is imposed on a laser beam having a divergence of between 1 degree and 4 degrees. The beam (27) is directed by an operator, sighting through a telescopic viewing device (26), at a distant transceiver which collects light in the laser beam and extracts the communication signal. In preferred embodiments, the transceivers are handheld and each comprises a microphone (22) and earphone (20) allowing operators to talk with each other. Digital information can also be transmitted from personal computers and other electronic information equipment at the location of each operator. In a preferred embodiment useful for military and surveying applications, a GPS, a compass, and a laser ranging system is provided. This enables the operator to sight through a binocular to a target and determine its position in longitude, latitude and elevation. Target position information can then be transmitted to a distant transceiver which in this case could be a base transceiver.



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AMENDED CLAIMS

[received by the International Bureau on 31 December 1997 (31.12.97);
original claims 1-16 replaced by new claims 1-20 (6 pages)]

1. A laser communication transceiver for transmitting information via laser beams to another laser communication transceiver and for receiving information via laser beams from said another laser communication transceiver, said transceiver comprising:

A) a laser transmitter system comprising:

1) at least one laser operable to produce a signal laser beam of a selected range of wavelengths;

2) a signal modulator disposed relative to said laser and configured to modulate said signal laser beam to impose a digital communication signal on said signal laser beam;

B) a laser receiver disposed relative to said laser transmitter system and configured to receive a laser beam having a selected range of wavelengths from said another laser communication transceiver comprising:

1) an optical filter closely matched to at least one wavelength of said received laser beam;

2) a signal detector operable to receive and detect communication signals that are transmitted by said another laser communication transceiver through said optical filter;

C) a telescopic viewing device operable to locate said another similar laser communication transceiver and to facilitate pointing said transceiver in a direction of said another laser communication transceiver; and

D) a laser ranging unit, a GPS unit and an electronic compass.

2. A laser communication transceiver as in Claim 1 wherein said telescopic viewing device comprises a binocular.

3. A laser communication transceiver as in Claim 1 further comprising a tilt gage.

4. A laser communication transceiver as in Claim 1 further comprising a microphone and earphones.

5. A transceiver as in Claim 1 further comprising a video camera and an electronic view finder.

6. A transceiver as in Claim 1 further comprising a speaker.

7. A transceiver as in Claim 1 wherein said laser receiver comprises a photo diode, a preamplifier, a frequency to voltage converter and a data converter for detecting said communication signal and distinguishing said signal as sound or digital data suitable for input to a computer.

8. A laser communication transceiver for transmitting information via laser beams to another laser communication transceiver and for receiving information via laser beams from said another laser communication transceiver, said transceiver comprising:

A) a laser transmitter system comprising:

1) a Voight filter;

2) at least one laser disposed relative to said Voight filter and operable to produce a signal laser beam of a narrow band of wavelengths which is locked at or near 852.11 nm using said Voight filter;

3) a signal modulator disposed relative to said laser and configured to modulate said signal laser beam to impose a digital communication signal on said signal laser beam;

B) a laser receiver disposed relative to said laser transmitter system and configured to receive a laser beam having a selected range of wavelengths from said another laser communication transceiver comprising:

1) an optical filter closely matched to at least one wavelength of said received laser beam;

2) a signal detector operable to receive and detect communication signals that are transmitted by said another laser communication transceiver through said optical filter; and

C) a telescopic viewing device operable to locate said another similar laser communication transceiver and to facilitate pointing said transceiver in a direction of said another laser communication transceiver.

9. A laser communication transceiver as in Claim 8, wherein said narrow band of wavelengths is produced with a distributed Bragg reflector laser diode with feedback control.

10. A laser communication transceiver for transmitting information via laser beams to another laser communication transceiver and for receiving information via laser beams from said another laser communication transceiver, said transceiver comprising:

A) a laser transmitter system comprising:

1) at least one laser operable to produce a signal laser beam of a selected range of wavelengths;

2) a signal modulator disposed relative to said laser and configured to modulate said signal laser beam to impose a digital communication signal on said signal laser beam;

B) a laser receiver disposed relative to said laser transmitter system and configured to receive a laser beam having a selected range of wavelengths from said another laser communication transceiver comprising:

1) an atomic line filter configured to provide a noise equivalent bandwidth of less than 0.1 nm and to have a transmission band closely matched to at least one wavelength of said received laser beam;

2) a signal detector operable to receive and detect communication signals that are transmitted by said another laser communication transceiver through said atomic line filter; and

C) a telescopic viewing device operable to locate said another similar laser communication transceiver and to facilitate pointing said transceiver in a direction of said another laser communication transceiver.

11. A transceiver as in Claim 10 where said receiver atomic line filter is a Faraday filter.

12. A transceiver as in Claim 10, wherein said receiver atomic line filter is a Voight filter.

13. A laser communication device, comprising:

a transmitting module operable to produce a signal beam having at least one laser that produces said signal beam and a first atomic optical filter based on an atomic medium that is disposed relative to said laser to receive at least a portion of said signal beam, wherein said first atomic optical filter produces an optical feedback signal based on an atomic transition line of said atomic medium and said laser is locked to said atomic transition line; and

a receiving module disposed relative to said transmitting module and configured to have a second atomic optical filter based on said atomic medium wherein said second atomic optical filter is configured to receive light having a frequency at said atomic transition line and to block light at other frequencies.

14. A device as in claim 13, wherein said transmitting module further comprising a laser controller operable to control at least the frequency of said laser at said atomic transition line according to said optical feedback signal from said first optical filter.

15. A device as in claim 14, wherein said laser controller is operable to modulate the frequency of said laser relative to said atomic transition line of said first atomic optical filter according to a temporal modulation criterion to imprint communication data on said signal beam for transmission.

16. A device as in claim 13, wherein said first atomic optical filter is positioned in line with said laser so that said signal beam passes said first atomic optical filter.

17. A device as in claim 13, further comprising a beam-splitting element in the path of said signal beam to split said signal beam into a diagnostic signal beam and an output signal beam, wherein said first atomic optical filter is positioned not to intercept said signal beam and

said beam-splitting element directs said diagnostic signal beam to pass through said first atomic optical filter which generates said optical feedback signal.

18. A device as in claim 13, wherein said first and second atomic optical filters are selected from Voight and Faraday filters.

19. A device as in claim 14, wherein said laser is a diode laser and further comprising a partially reflecting element disposed relative to said diode laser and said first atomic optical filter, said reflecting element operating to partially reflect said portion of said signal beam received by said first atomic optical filter back to said diode laser so that the frequency of said diode laser is locked at said atomic transition line.

20. A laser communication transceiver for transmitting information via laser beams to another laser communication transceiver and for receiving information via laser beams from said another laser communication transceiver, said transceiver comprising:

A) a laser transmitter system comprising:

1) a Faraday filter;

2) at least one laser disposed relative to said Faraday filter and operable to produce a signal laser beam of a narrow band of wavelengths which is locked at or near 852.11 nm using said Faraday filter;

3) a signal modulator disposed relative to said laser and configured to modulate said signal laser beam to impose a digital communication signal on said signal laser beam;

B) a laser receiver disposed relative to said laser transmitter system and configured to receive a laser beam having a selected range of wavelengths from said another laser communication transceiver comprising:

1) an optical filter closely matched to at least one wavelength of said received laser beam,

2) a signal detector operable to receive and detect communication signals that are transmitted by said another laser communication transceiver through said optical filter; and

C) a telescopic viewing device operable to locate said another similar laser communication transceiver and to facilitate pointing said transceiver in a direction of said another laser communication transceiver.